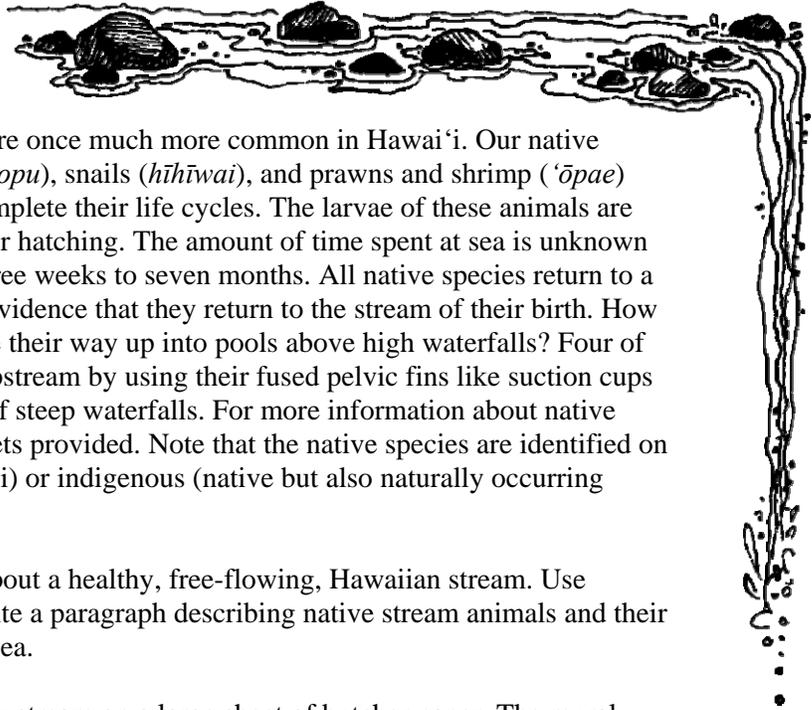


**Stream Change:** None



Streams that flowed freely to the sea were once much more common in Hawai‘i. Our native stream animals, such as goby fishes (*‘o‘opu*), snails (*hīhīwai*), and prawns and shrimp (*‘ōpae*) depend on a connection to the sea to complete their life cycles. The larvae of these animals are swept downstream into the sea soon after hatching. The amount of time spent at sea is unknown for most species and may range from three weeks to seven months. All native species return to a stream as young adults, but there is no evidence that they return to the stream of their birth. How do you suppose native goby fishes make their way up into pools above high waterfalls? Four of the five native gobies make their way upstream by using their fused pelvic fins like suction cups to cling to rocks and climb up the face of steep waterfalls. For more information about native stream animals, see the information sheets provided. Note that the native species are identified on the sheets as endemic (unique to Hawai‘i) or indigenous (native but also naturally occurring elsewhere).

**Task:** Design a way to teach students about a healthy, free-flowing, Hawaiian stream. Use artwork (see suggestions below) and write a paragraph describing native stream animals and their need for streams that flow freely to the sea.

**Suggestions:** Create a mural of a healthy stream on a large sheet of butcher paper. The mural should show a stream flowing from the mountains to the ocean. It may include waterfalls and boulders. Illustrate or make cutouts of native stream animals in the stream.

**Stream Change:** Channelization of Streams



Many Hawaiian streams have been straightened and lined with concrete. This makes it possible to build homes and other buildings closer to a stream and to control flooding. But channelization destroys the beauty of streams and reduces natural habitat for native stream animals that spend part of their lives in the sea. (Refer to the information sheets provided.) When streams are channelized, the water tends to be shallower in the wide concrete channels. Trees that once grew on stream banks are often removed. These changes cause water temperatures to rise, creating poor habitat for stream life. Also, during heavy rains the water flows more quickly through a straight channel than through a natural stream course, and stream animals are washed out to sea.

**Task:** Design a way to teach students about the need to conserve streams that have not been channelized and the need to plant shade trees along stream banks. Use artwork (see suggestions below) and write a paragraph to describe the problem and what can be done to save streams.

**Suggestions:** Create paper cutouts of a straight, concrete-lined stream channel to fit over the lower part of a stream on a class mural. Make cutouts of houses to fit on both sides of the channel and cutouts of trees to provide shade.

## Stream Change: Diversion of Stream Water



Water from more than half of the streams that once flowed freely to the sea in the Hawaiian Islands has been diverted for other uses. Most water is taken from wet mountain areas to drier areas for growing crops. At one time, water was diverted for sugar cane. When water is taken from the streams, the streams usually flow only during heavy rains. During the rest of the year the streambeds are dry. Native prawns (*‘ōpae*), goby fishes (*‘o‘opu*) and snails (*hīhīwai*) that spend part of their lives in the sea before returning to streams then lose habitat. (See the information sheets provided.) When water levels drop, small farm operations, particularly taro farms downstream, may not have the continual source of flowing water needed for their crops.

Streamflow is also lowered when groundwater or water stored in the mountains is pumped for use in people’s homes. This pumping can eliminate springs that feed into streams. By conserving our use of water we can help to keep water flowing in our streams!

**Task:** Design a way to teach students about: 1) what happens when water is taken from streams, 2) the need to prevent more diversions, and 3) the need to conserve water in our homes and schools. Use artwork (see suggestions below) and write a paragraph to describe the problem and what can be done to save streams.

**Suggestions:** Create cutouts for a class mural to show water being taken from a stream in a long ditch that leads to a sugar cane crop. Create cutouts that show a dry streambed downstream. You may also want to include a cutout of a house where water is being wasted.

## Stream Change: Non-native Animals



People have introduced many non-native animals to the Hawaiian Islands. Wild pigs, goats, deer and cattle grazing in fields can all affect the quality of streams. When these animals remove plant cover, either by rooting up plants or heavy grazing, soil erodes into streams. Muddy streams provide poor habitat for stream animals, and when the stream empties into the sea the soil can smother and kill reefs. One way to prevent further damage is to remove these animals from areas around high-quality streams and build fences to keep the animals out.

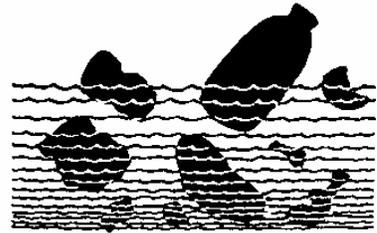
Smaller animals that have been introduced to streams, such as Tahitian prawns, tilapia, frogs, and guppies prey on and/or compete with native stream life for food and habitat. These non-native stream animals are multiplying in our streams and the native species are declining. Some of the native stream animals occur only in Hawai‘i and nowhere else in the world! (See the information sheets for more information.) People can help to solve this problem by preventing new animals from being released in our streams.

**Task:** Design a way to teach students about the effects of non-native animals on our streams and ways that we can prevent further damage. Use artwork (see suggestions below) and write a paragraph that describes how these animals are changing streams and what individuals can do.

**Suggestions:** Create paper cutouts of non-native stream animals and larger animals such as pigs, goats and deer, to place in and around a stream on a class mural. Cutouts of soil eroding into a stream or of a muddy stream to place over part of the class mural could also be included.

## Stream Change: Pollution

Many people are polluting our streams and the ocean without even knowing it! Lawn chemicals, paint, oil, gasoline, cleaning solutions or litter that get washed down driveways into streets can end up in storm drains that flow into streams and into the ocean. After a heavy rain, these pollutants end up in the sea. Some of the pollution is garbage, such as plastic bags, broken bottles, or cans. The plastic litter is particularly harmful to marine animals, such as endangered green sea turtles that mistake bits of plastic for edible jellyfish or seaweed. The turtles either choke or become engorged on plastic and starve. Seals, seabirds and other marine animals sometimes become trapped in plastic, especially nets and plastic soda can rings, which can cause the animals to starve or choke to death.



Careless human actions in Hawai'i are believed to contribute up to ten times as much pollution to streams and beaches as all our factories and industries combined. If every person realized the consequences of his/her actions and made an effort to stop this pollution, Hawaiian streams and beaches would be healthier and more beautiful.

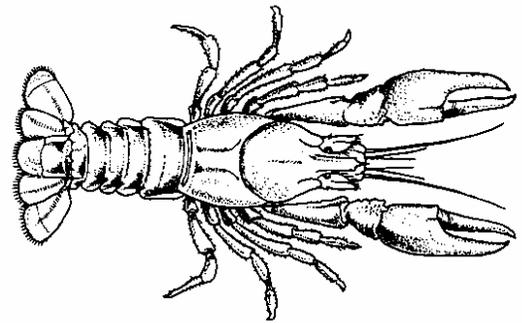
**Task:** Design a way to teach students how to prevent the careless pollution of our streams and beaches. Use artwork (see suggestions below) and write a paragraph explaining how people contribute to pollution and what they can do about it.

**Suggestions:** Create cutouts of pipes leading from gutters along streets into storm drains and into the stream on a class mural. Include cutouts of garbage, chemicals and other pollutants that wash into streams. You might also want to include a sign on the stream bank that warns people to stay out of the contaminated water.

**Crayfish** Introduced

*(Procambarus clarkii)*

Crayfish have been introduced to Hawaiian streams where they compete with native stream life for food and habitat. These scavengers feed on a wide range of plants, animals and decaying matter.



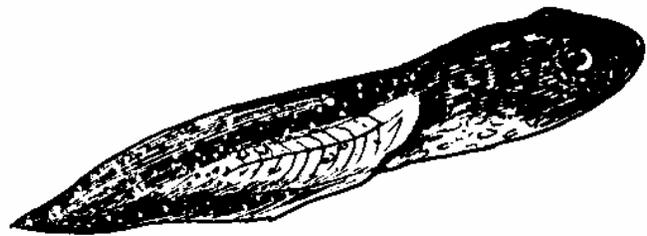
**Description:** up to 10 cm (4 in) long; brownish gray to red

**Habitat:** introduced to streams on O‘ahu, Kaua‘i and Hawai‘i; may be found on other islands.

**Wrinkled frog tadpole** Introduced

*(Rana rugosa)*

Wrinkled frog tadpoles hatch from eggs in a jelly-like mass found near plants in calm stream water.



**Description:** 4 cm (1.5 in) long; greenish gray

**Habitat:** streams

**Wrinkled frog** Introduced

*(Rana rugosa)*

Wrinkled frogs can be found basking on rocks or diving in shallow pools. They get their name from the narrow ridges on their backs, which give them a wrinkled appearance.



**Description:** less than 5 cm (2 in); charcoal or brownish-gray body

**Habitat:** rocks along stream banks and shallow pools.

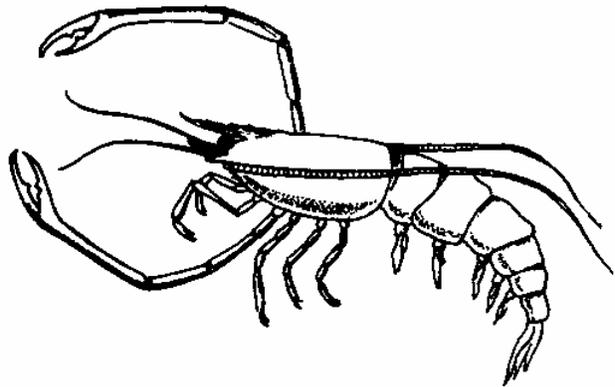
**Tahitian prawn** Introduced

*(Macrobrachium lar)*

This aggressive prawn was introduced to two Hawaiian streams in the 1950s. Only 15 years later it was found in nearly every stream in the islands.

**Description:** up to 16 cm (6 in); thin, bluish pincer legs, brown body

**Habitat:** free-flowing streams on all main islands



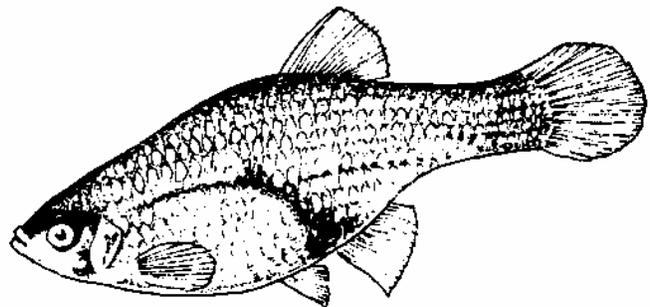
**Guppy** Introduced

*(Poecilia reticulata)*

Guppies are a popular aquarium fish that were introduced to Hawaiian streams by people.

**Description:** males 3 cm (1 1/8 in) long, females twice that size; males can be colorful; females are drab brown

**Habitat:** lower reaches of streams throughout the islands



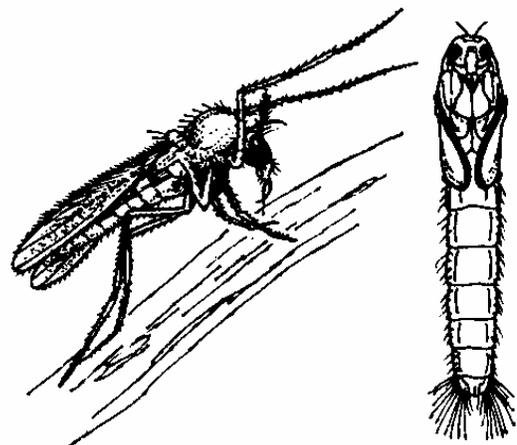
**Midge fly** Endemic

*(Chironomus spp.)*

Midge fly larvae construct a tube-like shelter out of stream pebbles and sand. They breathe through long gills found on their last body segment.

**Description:** size of mosquitos; green-brown color

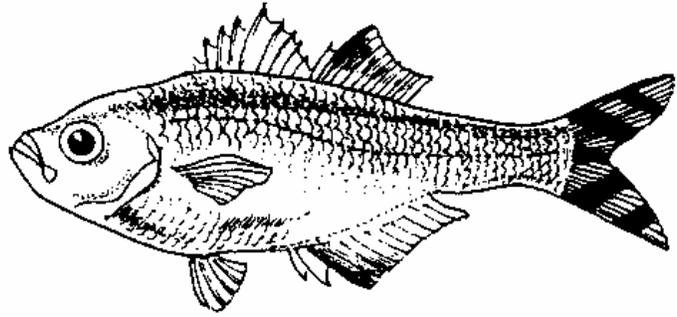
**Habitat:** larvae found in streams; adults are often seen swarming near streams.



**Āholehole** Endemic

(*Kuhlia sandvicensis*)

Āholehole is the young stage of the āhole fish. Hole is a Hawaiian word that means to strip away. Hawaiians believed the fish could chase away evil spirits.



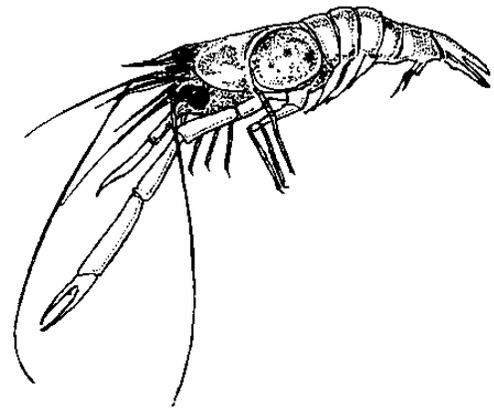
**Description:** a silver fish, 15–25 cm (6–10 in) long

**Habitat:** young fish are common in streams; adults are found in brackish water and in fairly deep tidal pools.

**‘Ōpae ‘oeha‘a** Indigenous prawn

(*Macrobrachium grandimanus*)

Grandimanus means large hand. The native prawn uses its large claw to defend its territory where it feeds on small pieces of plant and animal matter.



**Description:** 13 cm (5 in) long; one large claw; gray color

**Habitat:** found in free-flowing streams

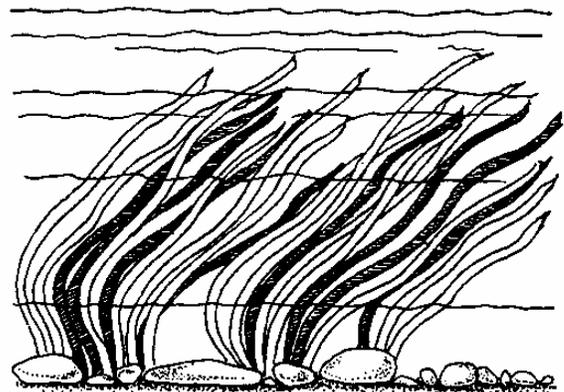
**Limu kalawai** Indigenous

(*Spirogyra* spp.)

This freshwater algae is a source of food for stream animals.

**Description:** rows of cylindrical cells with narrow, spiral, green bands

**Habitat:** streams and ponds



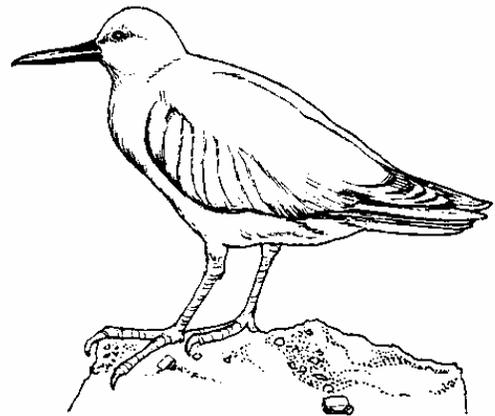
**‘Ūlilī** Indigenous wandering tattler

(*Heteroscelus incanus*)

With a whistle-like call that sounds like its Hawaiian name, the ‘ūlilī searches for insects and mollusks along streams and shorelines.

**Description:** 28 cm (11 in) tall; dark gray above, light gray below, yellow legs

**Habitat:** mudflats, rocky coasts and streams



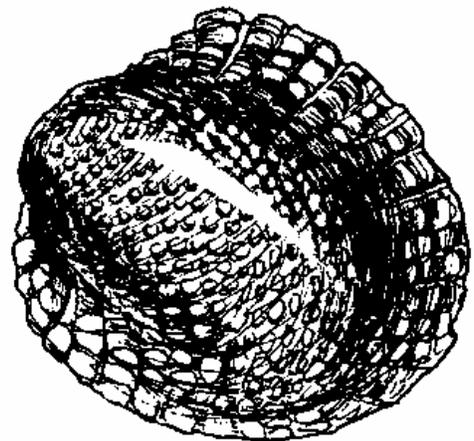
**Hihīwai** Endemic snail

(*Neritina granosa*)

Like other native stream life, the larvae of these snails are washed into the sea where they slowly develop. As tiny snails, they return to a stream and the cycle begins again.

**Description:** up to 5 cm (2 in); black shell

**Habitat:** found up to 370 m (1,200 ft) elevation in streams that flow freely to the sea.



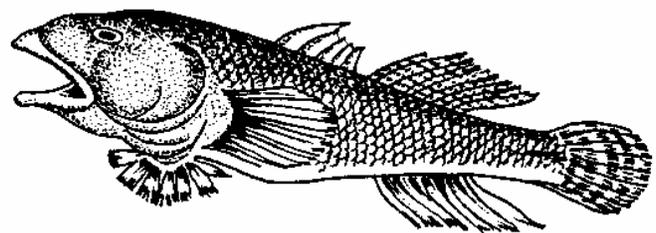
**‘O‘opu nākea**, goby Endemic

(*Awaous stamineus*)

This native freshwater goby is considered a delicacy, but overfishing and human disturbances to streams have caused its population to decline. *Nākea* feeds on green algae and occasionally on shrimp.

**Description:** up to 46 cm (18 in) long; *nākea* is the largest native ‘o‘opu; its brown color matches the streambed.

**Habitat:** lives primarily in lower reaches of streams.



***Pinao*** (dragonfly)      Endemic

(*Anax strenuus*)

This *pinao* is larger than the largest dragonfly in North America. Adults hold their front legs together to form insect-catching baskets!

**Description:** 5–13 cm (2–5 in) juvenile-adult; head and thorax are green, males’ abdomens are pale blue, females grayish-brown

**Habitat:** larvae spend about one year maturing in streams; adults are found near streams and wetlands.



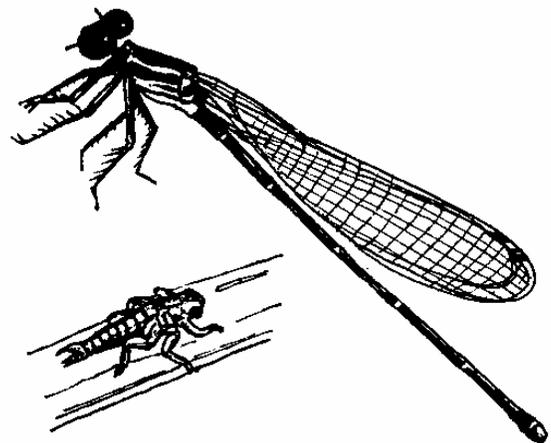
**Damselfly**      Endemic

(*Megalagrion* spp.)

Most young damselflies live and grow in streams and ponds. In Hawai‘i some young damselflies (nymphs) live in water that collects between leaves and stems of native plants!

**Description:** Some Hawaiian damselflies are among the largest in the world: 4–5 cm (1.5–2.5 in) long, with narrow 7–13 cm (3–5 in) wings; red, blue, green, or silver.

**Habitat:** rainforests, particularly near streams



**Polychaete worm** Endemic

(*Nemelycastis hawaiiensis*)

The polychaete (pronounced poly-keet) worm helps to recycle nutrients by feeding on decaying matter in Hawaiian streams.

**Description:** 10 cm (4 in) long, fleshy pink color; has four eyes.

**Habitat:** found beneath rocks in streams and estuaries on O‘ahu, Kaua‘i and Hawai‘i.

